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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/788,778

02/26/2004

Jeffrey H. Hunt

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02/28/2006

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EXAMINER

YAM, STEPHEN K

ART UNIT

PAPER NUMBER

2878

DATE MAILED: 02/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/788,778

Applicant(s)

HUNT, JEFFREY H.

Examiner

Stephen Yam

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 13-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 13-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This action is in response to Amendments and remarks filed on December 19, 2005. Claims 1-11 and 13-25 are currently pending.

Terminal Disclaimer

1. The terminal disclaimers filed on December 19, 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of 10/863,866 and US-6,829,072 have been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-11 and 13-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over J.H. HUNT and R.B. HOLMES, *Observation of Optical Response of Avalanche Photodiodes at Photon-Counting Light Levels*, Journal, May 30, 1994, 3 pgs., Appl. Phys. Lett. 64 (22) (hereinafter Hunt et al) in view of Vickers US Patent No. 6,720,588.

Regarding Claims 1, 14, 22, 23, and 25, Hunt et al. teach (see Fig. 2) a device comprising a photodiode (APD) which is sensitive to a wavelength of light (see Page 2925, column 1, lines 7-31), a first source of photons (850nm diode laser) at a first wavelength (850nm) to which the

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photodiode is sensitive (see Fig. 1 and Page 2927, column 1, lines 10-11) incident on the photodiode, a second source of photons (1300nm diode laser) at a second wavelength (1300nm) to which the photodiode is insensitive incident on the photodiode (see Fig. 1), an electric field across the photodiode in excess of a breakdown voltage thereof (definition of Geiger mode for an avalanche photodiode- see Page 2925, column 1, lines 7-13) and configured to result in an avalanching of electrons in the photodiode when the photons from the first source strike the photodiode (see Page 2925, column 1, lines 21-25), the avalanching electrons resulting in a photorefractive response which changes the index of refraction in the photodiode (see Page 2925, lines 23-31), and a capture device (CCD camera) in optical communication with (see Fig. 2) and configured to capture light reflected from the photodiode (reflected read photons- see Fig. 1 and 4). Regarding Claim 23, Hunt et al. teach (see Fig. 2) a method, comprising biasing a photodiode to operate in Geiger mode (see Page 2925, column 1, lines 10-13), irradiating a photodiode (APD) with a first wavelength (850nm) of light (from 850nm diode laser) to which the photodiode is sensitive (see Fig. 1 and Page 2927, column 1, lines 10-11), the first wavelength of light transmitting an optical signal (see Fig. 4a), irradiating the photodiode with a second wavelength (1300nm) of light (from 1300nm diode laser) to which the photodiode is insensitive (see Fig. 1), modulating (see Page 2926, column 2, lines 33-35) light reflected from a surface of the photodiode with a photorefractive reaction within the photodiode (see Page 2925, column 1, lines 21-31), and capturing (with CCD camera) the modulated reflected light (read photons- see Fig. 1 and 4). Regarding Claim 25, Hunt et al. teach (see Fig. 2) a method comprising configuring a photodiode (APD) to operate in Geiger mode (see Page 2925, column 1, lines 10-13), irradiating (see Fig. 2) the photodiode with a first wavelength of light (from

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850nm diode laser) transmitting an optical signal (see Fig. 4a), initiating a photorefractive reaction (see Page 2925, column 1, lines 21-31) within the photodiode with the first wavelength of light (see Fig. 1), irradiating the photodiode with a second wavelength of light (from 1300nm diode laser) to which the photodiode is insensitive (read photon- see Fig. 1), modulating (see Page 2926, column 2, lines 33-35) light reflected from a surface of the photodiode (see Fig. 1) with the photorefractive reaction within the photodiode (see Page 2925, column 1, lines 21-31), and capturing (with CCD camera) the modulated reflected light (read photons- see Fig. 1 and 4). Regarding Claims 14 and 22, Hunt et al. also teach the first source of photons transmitting/emitting an optical signal (see Fig. 4a). Regarding Claim 22, Hunt et al. teach the photodiode having a bandgap (see Fig. 1), with the photodiode configured to operate in Geiger mode (See Page 2925, column 1, lines 10-13), with first wavelength less than the bandgap of the photodiode (since the write photons are absorbed- see Fig. 1), and the second wavelength greater than the bandgap of the photodiode (since the read photons are reflected- see Fig. 1). Hunt et al. do not teach the photodiode as an InGaAsP photodiode. Vickers teaches a similar avalanche photodiode (APD) operating in Geiger mode (see Col. 2, lines 63-67), in which an electric field across the photodiode in excess of a breakdown voltage thereof is configured to result in an avalanching of electrons in the photodiode when photons strike the photodiode (see Col. 2, lines 63-67), with the photodiode composed of InGaAsP (see Col. 7, lines 23-26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a InGaAsP photodiode as taught by Vickers, in the device of Hunt et al., since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding Claim 2, Hunt et al. teach the first source of photons transmitting an optical signal (see Fig. 4a) to the photodiode.

Regarding Claims 3 and 15, Hunt et al. teach the first wavelength less than the bandgap of the photodiode (since the write photons are absorbed- see Fig. 1).

Regarding Claims 4 and 16, Hunt et al. teach the second wavelength greater than the bandgap of the photodiode (since the read photons are reflected- see Fig. 1).

Regarding Claims 5 and 17, Hunt et al. teach the light reflected from the photodiode is modulated by the photorefractive response of the photodiode (see Page 2925, column 1, lines 21-31).

Regarding Claims 6 and 18, Hunt et al. teach a beam combiner (intensity beam splitter) configured to combine the first and second wavelengths (see Page 2926, column 1, lines 1-2), the beam combiner positioned between the photon sources and the photodiode (see Fig. 2).

Regarding Claim 7, Hunt et al. teach at least one optical filter (Attenuator/Spatial filter, $\lambda/4$ plate) positioned between the photon sources and the photodiode (see Fig. 2).

Regarding Claim 8, Hunt et al. teach the optical filter comprises a $\lambda/4$ plate (see Fig. 2).

Regarding Claim 9, Hunt et al. teach the capture device comprises at least one device selected from the group consisting of cameras, CCD devices, imaging arrays, and photometers (see Fig. 2 and Page 2926, column 2, lines 11-19).

Regarding Claim 10, Hunt et al. teach (see Fig. 2) at least one optical component (20x telescope objective) positioned between at least one of the photon sources and the photodiode.

Regarding Claim 11, Hunt et al. teach the at least one optical component is selected from the group consisting of wavelength filters, spatial filters, shutters, light modulators, light valves, lens, lens systems, and objectives (see Fig. 2).

Regarding Claims 13 and 21, Hunt et al. teach the photodiode configured to operate in Geiger mode (See Page 2925, column 1, lines 10-13).

Regarding Claim 19, Hunt et al. teach a polarizing plate ($\lambda/4$ plate) positioned between the photon sources and the photodiode (see Fig. 2).

Regarding Claim 20, Hunt et al. teach the capture device comprising a camera (see Fig. 2 and Page 2926, column 2, lines 11-19).

Regarding Claim 24, Hunt et al. teach filtering the modulated reflected light (with 1000nm filter) prior to capture (see Fig. 2).

Response to Arguments

4. Applicant's arguments filed December 19, 2005 have been fully considered but they are not persuasive.

Applicant argues that modifying the Hunt invention with the disclosure of Vickers is improper. Examiner asserts that while the particular application and embodiment of Vickers may differ from Hunt, the underlying principle and objective of detecting single photons using an avalanche photodiode is shared by both the Hunt and Vickers references. Since the use of the particular InGaAsP material for an avalanche photodiode is taught by Vickers, the knowledge of such materials to be combined with Hunt is proper. Examiner further asserts that "it has been held to be within the general skill of a worker in the art to select a known material on the basis of

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its suitability for the intended use as a matter of obvious design choice." See *In re Leshin*, 125 USPQ 416.

Applicant also appears to argue that combining the disclosed *invention* of Vickers with Hunt is improper and cites portions of Vickers that Applicant considers as improper for modification of the Vickers *invention*. Examiner asserts that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen Yam whose telephone number is (571)272-2449. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on (571)272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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THANH X. LUU
PRIMARY EXAMINER